## Honeycomb Catalyst Precious Metals Analysis

Version 2016-03-23

**Legend**

| Data Entry Cell | Result Calculation | Instrument Calibration Out of | LOD - limit of detection |
|---|---|---|---|

| | |
|---|---|
| Engine Family | HAMLC.198QPA |
| VIN/Serial No. | LXAPDZ055HX000028 |
| Task Directive | TD2, Opt 2 |
| Entry Number | ATG-1015158-3 |
| Inspection Number | 20161219-1245-04 |
| Catalyst Inspection Date | 12/19/2016 |
| Certificate Catalyst Manufacturer | Chongqing Guiyan Sino-Platinum Metals Catalyst Co., Ltd. |
| Certificate Catalyst Part Number | LF4212-552-70 |
| Observed Catalyst Markings | None |

| | |
|---|---|
| Instrument Used | X-5000 (S/N: 202212) |
| Calibration Curve Name | Metallic Curve 2016-01-19 |
| Check Standard ID | Ledoux-11 |

### Daily Check Standard Results

| | Measured Value (% concentration) | Measured Value (ppm) | Known Concentration Value (ppm) | Percent Difference (Measured vs. Known Value) | Control Charting Checks |
|---|---|---|---|---|---|
| Pt | 0.231 | 2,306 | 2,021 | [redacted] | OK |
| Pd | 1.256 | 12,556 | 12,474 | | OK |
| Rh | 0.120 | 1,202 | 1,192 | | OK |

### Measured Precious Metals Concentrations with X5000

| | Measured Value (% concentration, by weight) | x-5000 LOD (% Concentration by weight) | Measured Value (ppm) | x-5000 LOD (ppm) |
|---|---|---|---|---|
| Pt | 0.0830 | 0.0026 | 830 | 26 |
| Pd | 0.6879 | 0.0056 | 6,879 | 56 |
| Rh | 0.0746 | 0.0013 | 746 | 13 |
| Ce | 42.0400 | 0.3300 | 420,400 | 3,300 |
| Zr | 3.7439 | 0.0283 | 37,439 | 283 |

### Certified Precious Metals Data

| | Reported Cert Ratio | Reported Cert Loading Value | Reported Cert Loading Value Units | Calculated Cert. Loading Value (g/L) | Calculated Ratio from Measurement | Cert Ratio | Difference (%) (Measured Vs. Certified |
|---|---|---|---|---|---|---|---|
| Pt | [redacted] | | | | 1.1 | | |
| Pd | | | | | 9.2 | | |
| Rh | | | | | 1.0 | | |
| Total: | | | | | | | |

### Material Weight Reconciliation

| Pre-Extraction/Separation Weights (g) | | Post-Extraction/Separation Weights (g) | | Mass Balance Calculations Weights (g) | | Percent Losses |
|---|---|---|---|---|---|---|
| Weight of Catalyst | 373.09 | Post Extraction: Weight of Catalyst | 368.08 | Theoretical PM and Ferrous Metals | 5.01 | [redacted] |
| Empty Glass Vial (w/ lid) | 59.33 | Post Extraction: Glass Vial (w/ lid, PM, and ferrous metals) | 64.26 | Extracted PM and Ferrous Metals | 4.93 | |
| Empty Glass Vial (w/ lid) | 59.33 | Post Separation: Glass Vial (w/ lid and ferrous metal only) | 63.68 | Extracted Ferrous Metals | 4.35 | |
| Empty Sample Cup (no lid, no Mylar) | 4.19 | Sample Cup with PM (no lid or Mylar) | 4.76 | Extracted PM Sample | 0.57 | |
| | | | | Total Material Lost | 0.09 | 1.80% |

### Drilling Information

**Hole 1**

| | 1st Measured Value (inches) | 1st Measured Value (inches) | 3rd Measured Value (inches) | 4th Measured Value (inches) | Calculated Average Value (inches) |
|---|---|---|---|---|---|
| Hole Diameter Side 1 | 0.3900 | 0.4055 | 0.3840 | 0.4055 | 0.3963 |
| Hole Diameter Side 2 | 0.3940 | 0.4250 | 0.4010 | 0.4145 | 0.4086 |
| Drill Bit Diameter (in.) | 3/8 | | | | |

**Hole 2**

| | 1st Measured Value (inches) | 1st Measured Value (inches) | 3rd Measured Value (inches) | 4th Measured Value (inches) | Calculated Average Value (inches) |
|---|---|---|---|---|---|
| Hole Diameter Side 1 | | | | | -- |
| Hole Diameter Side 2 | | | | | -- |
| Drill Bit Diameter (in.) | | | | | |

### Loading Results

| | Calculated Extracted Powder Weight | | Cert Value - Loading (g/L) | Calculated Metals Loading | | Percent D Loadin |
|---|---|---|---|---|---|---|
| | Result (g) | LOD (+/- g) | | Result (g/L) | LOD (+/- g/L) | Result (%) |
| Pt | 0.00047 | +/- 0.00001 | [redacted] | 0.064 | +/- 0.002 | [redacted] |
| Pd | 0.00392 | +/- 0.00003 | | 0.530 | +/- 0.004 | |
| Rh | 0.00043 | +/- 0.00001 | | 0.057 | +/- 0.001 | |
| **Total** | **0.00482** | **+/- 0.0001** | | **0.651** | **+/- 0.007** | |

| | |
|---|---|
| Test Conditions | 3 runs, 90 seconds each |
| Check Standards | The check standard results passed all daily control charting checks. |
| Comments: | The Cert. App reported only 1 set of ratios and loadings for the two catalysts. The loading [redacted] was clearly identified for both the front and rear catalyst but the ratio [redacted] was not. ERG assumed that the reported ratio applies to both catalysts. |
| Pt Qualifiers | [redacted] |
| Pd Qualifiers | |
| Rh Qualifiers | None |
| Ratios: | The calculated ratio for Pt : Pd : Rh was 1.1 : 9.2 : 1 |
| Pt Loading: | [redacted] |
| Pd Loading: | |
| Rh Loading: | |
| Total Loading: | |
| Areas of Concern | |
| Related Photo(s) | DSCN6423 - DSCN6600 |
| Inspector(s): | Cassidy Owen |
| Report Date: | 12/22/2016 |